

CLAIMS

1. A speech processing apparatus comprising:

a data store operable to store a plurality of word
5 models;

a receiver operable to receive an utterance; and

a matching unit operable to determine which of a
plurality of word models stored in said data store most
closely matches an utterance received by said receiver,
10 said matching unit being arranged to output a value
indicative of the goodness of each match between a most
closely matching word model and an utterance received by
said receiver;

characterized by further comprising:

15 a confidence model store operable to associate each
word model stored in said data store with data indicative
of the probability of a said value indicative of the
goodness of match being output if said word model
correctly or incorrectly matches an utterance; and

20 a confidence score output unit operable to determine
and output a confidence score indicative of a calculated
posterior probability that a received utterance has been
correctly matched to a word model given that the match
resulted in the output of a particular value indicative
25 of goodness of match, said output unit being arranged to

calculate said confidence score for a match utilizing said value output by said matching unit and said data associated with the word model matched to utterances by said confidence model store.

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2. Apparatus in accordance with claim 1, wherein said matching unit is arranged to output a plurality of values indicative of the goodness of a match, wherein said confidence model store is arranged to associate data indicative of the probability of each of said output values being output, and wherein said output unit is arranged to calculate said confidence scores for matches utilizing said plurality of output values and said data associated with word models by said confidence model store.

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3. Apparatus in accordance with claim 1, wherein said matching unit is arranged to determine match scores indicative of the correspondence between an utterance and word models, and output as a value indicative of the goodness of a match of the match score for the most closely matching word model.

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4. Apparatus in accordance with claim 3, wherein said matching unit is arranged to output as a value indicative

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of the goodness of a match, data indicative of the ratio of a match score indicative of the correspondence between an utterance and a most closely matching word model and a match score for the correspondence between an utterance and a different word model.

5 5. Apparatus in accordance with claim 4, wherein said different word model comprises the second most closely matching word model to an utterance.

10 6. Apparatus in accordance with claim 4, wherein said different word model comprises the most closely matching word model to an utterance that is representative of a different word to said most closely matching word model.

15 7. Apparatus in accordance with claim 1, wherein said confidence model store is arranged to associate the same data with all word models stored within said data store.

20 8. Apparatus in accordance with claim 1, wherein said confidence model store is arranged to associate different data with different word models stored within said data store.

25 9. Apparatus in accordance with claim 8, wherein said

confidence model store is arranged to associate groups of word models stored in said data store with different data.

5 10. Apparatus in accordance with claim 1, wherein said confidence model store is arranged to associate with each word model data defining a probability density function of the probabilities of a said value being output if said word model correctly or incorrectly matches an utterance.

10 11. An apparatus in accordance with claim 10, wherein said data defining a probability density function comprises data defining a function type and a one or more parameters.

15 12. An apparatus in accordance with claim 10, wherein said output unit is arranged to determine probabilities that a value indicative of goodness of match would be output if a word is correctly or incorrectly matched
20 utilizing said data defining probability functions associated with a matched word and to utilize said determined probabilities to calculate said confidence score.

25 13. An apparatus in accordance with claim 1, wherein

said confidence model store is further arranged to associate with word models data indicative of the probability of word models being correctly or incorrectly matched to any utterance, wherein said output unit is arranged to utilize said data to calculate said confidence score.

14. A method of generating data for association with word models stored within a speech processing apparatus in accordance with claim 1, the method comprising the steps of:

determining for each utterance in a test vocabulary of known words, word models matched to said test utterances and said values output by said matching unit;

for utterances correctly matched to known words in said test vocabulary, determining a function corresponding to the probability of said values indicative of goodness of match arising;

for utterances incorrectly matched to known words in said test vocabulary, determining a function corresponding to the probability of values indicative of goodness of match arising; and

outputting data representative of said determined functions.

15. A method in accordance with claim 14, further comprising the steps of determining the proportion of utterances correctly or incorrectly matched to a word model and outputting data representative of the probability of a word model being correctly or incorrectly matched.

16. A method in accordance with claim 14, wherein said determination steps are performed for each word model stored in said speech processing apparatus and data is output for association with each of said models.

17. A method in accordance with claim 14, wherein said determination steps are performed for each word model stored in said speech processing apparatus representative of words of selected lengths and data is output for association with groups of models representative of words of said selected lengths.

18. A method in accordance with claim 14, further comprising the step of:

storing said output data in association with word models stored within a speech processing apparatus.

19. A method in accordance with claim 18, further

comprising the steps of:

for a set of test utterances representative of known words, utilizing said speech processing apparatus to determine for said set of test utterances, a set of
5 matched word models and output confidence scores;

for word models matched to test utterances determining the difference between the sum of confidence scores for utterances matched to each said word model and the number of utterances correctly matched to said word
10 model; and

generating further data for association with a word model if said difference is greater than a predetermined proportion of said test utterances matched to said word
15 model.

20. A method of speech processing comprising the steps of:

storing a plurality of word models;

associating each word model with data indicative of
20 the probability of a value indicative of the goodness of a match being calculated if said word model correctly or incorrectly matches an utterance;

receiving an utterance;

calculating a value indicative of the goodness of
25 the match between a most closely matching word model of

said plurality of word models and the received utterance;
and

determining and outputting a confidence score
indicative of a calculated posterior probability that a
received utterance has been correctly matched to a word
model given that the match resulted in the calculation
of said value indicative of goodness of match utilizing
said value and said data associated with said word model.

21. A method in accordance with claim 20, wherein a
plurality of values indicative of the goodness of a match
are calculated, said associating step comprising
associating for each word model with data indicative of
the probability of each of said values being calculated
if said word model correctly or incorrectly matches an
utterance and wherein said confidence score is calculated
utilizing said plurality of calculated values and said
data associated with said word models.

22. A method in accordance with claim 20, wherein said
calculated value indicative of the goodness of the match
comprises a determined match score indicative of the
correspondence between a received utterance and a stored
word model.

23. A method in accordance with claim 20, wherein said calculated value indicative of the goodness of a match comprises data indicative of the ratio of a match score indicative of the correspondence between an utterance and a most closely matching word model and a match score for the correspondence between an utterance and a different word model.

24. A method in accordance with claim 23, wherein said different word model comprises the second most closely matching word model to an utterance.

25. A method in accordance with claim 23, wherein said different word model comprises the most closely matching word model to an utterance that is representative of a different word to said most closely matching word model.

26. A method in accordance with claim 20, wherein said association step comprises the step of storing data indicative of probability density functions of a value being output if a said word model correctly or incorrectly matches an utterance.

27. A recording medium storing computer implementable processor steps for generating within a programable

computer an apparatus in accordance with any of claims 1 to 13 or for causing a programable computer to perform a method in accordance with any of claims 20 to 26.

5 28. A recording medium in accordance with claim 27, comprising a computer disc.

10 29. A computer disc in accordance with claim 28, wherein said computer disc comprises an optical, a magneto-optical or magnetic disc.

30. A recording medium in accordance with claim 28, comprising electric signal transferred via the Internet.

15 31. A speech processing apparatus comprising:
storage means for storing a plurality of word models;

receiving means for receiving an utterance; and

20 matching means for determining which of a plurality of word models stored in said storage means most closely matches an utterance received by said receiving means, said matching means being arranged to output a value indicative of the goodness of each match between a most closely matching word model and an utterance received by
25 said receiving means;

characterized by further comprising:

association means associating each word model stored in said storage means with data indicative of the probability of a said value indicative of the goodness of match being output if said word model correctly or
5 incorrectly matches an utterance; and

determining means for determining and outputting a confidence score indicative of a calculated posterior probability that a received utterance has been correctly
10 matched to a word model given that the match resulted in the output of a particular value indicative of goodness of match, said determining means being arranged to calculate said confidence score for a match utilizing said value output by said matching means and said data
15 associated with the word model matched to utterances by said association means.